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ABSTRACT

The University of Minnesota offered an experimental course to teach people to develop performance-based instruction courses and programs for education and industry. Computer-based teacher education was provided through distance delivery independent study with tutoring. The course was designed using the performance-based instructional design procedures being taught. Data were collected from 17 of the 21 people who started the course. Forty-seven percent indicated that their attitudes toward computer-assisted instruction (CAI) changed for the better; 76 percent had very good or good opinions about CAI; 82 percent said that the CAI format of the course would help them as instructors; and 93 percent of those who responded to the question about expectations about the course indicated that expectations were met. Some unique planning and delivery problems were posed for teacher educators by delivery of teacher education courses through distance delivery CAI; these problems concerned course structure, course orientation, teaching time, and learner time. Advantages to the delivery method were self-pacing, taking of courses at remote locations, savings for teacher education institutions, savings of time and money for students, and higher probability of mastery of course content and higher quality of products. Primary disadvantages were lack of immediate feedback, time to operate a computer, and no textbook for reference. (YLB)

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COMPUTERIZED DISTANCE DELIVERY OF VOCATIONAL TEACHER EDUCATION

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Paper presented at the
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Orientation

This presentation was part of a total session in which four alternative formats for the delivery of computer-based teacher education were discussed. All four experimented with the same computer-based tutorial program entitled Performance-Based Instructional Design (Pucel, 1986). The four formats were:

1. Tutored computer classrooms (The New York Experience)
2. Traditional instruction supplemented with assigned independent computer activities (The Illinois Experience)
3. Distance delivery independent study with tutoring (The Minnesota Experience)
4. Computerized field-based staff development (The Pennsylvania Experience).

This presentation specifically addressed distance delivery independent study with tutoring (The Minnesota Experience).

Introduction

About one-half of the people who enter vocational teaching at the postsecondary level in Minnesota do so without degrees in education. Therefore, they must receive their pedagogical training while employed within the 33 public Technical Institutes and the private vocational schools located throughout Minnesota. In addition, trainers in business and industry often find that they must develop training skills while employed.

Providing the pedagogical courses needed by these people creates unique problems for colleges and universities. Such educators and trainers find it difficult to take advantage of day classes offered on university campuses. Often the numbers of

people needing training at any one time are small, they are geographically spread out, and they have limited amounts of time to spend formally studying pedagogical practices. Therefore, alternative methods of delivering instruction must be sought.

One method of meeting the needs of these people is through distance delivery approaches which allow them to take the courses without attending formal class sessions or coming to campus. However, it is recognized that if courses are to be offered through distance delivery, the instruction must be controlled. Learners must have access to people to answer questions, and the quality of instruction and learning must be monitored.

During the summer of 1987 the University of Minnesota offered an experimental course designed to address this unique situation. It allowed learners to work at their own pace and locations throughout the summer (10 weeks) using computer-assisted instruction (CAI). A condition for enrolling in the course was that a person had to arrange for access to an IBM PC or compatible microcomputer. They could actually work on the course wherever they wanted to (e.g., home, work, university).

Course Characteristics

The course was designed to meet the standard curriculum development licensure requirements for Minnesota vocational-technical education teachers as well as to meet certification requirements for trainers. It was offered for 3 graduate or undergraduate quarter credits through the Division of Industrial Education. Nine hours of instruction were delivered through formal class sessions (initial and wrap-up sessions) and the

remaining instruction was through independent study. The course was designed to teach people to develop performance-based instruction courses and programs for education and industry.

The course itself was designed using the performance-based instructional design procedures being taught. It was taught as a self-paced course in which people were expected to master each component of the instructional design process. The following is a list of the characteristics of the CAI independent study format used.

1. It was offered on an independent study basis.
2. Instructional materials included a manual and self-instruction computer program that operates on IBM PCs or compatibles (Performance-Based Instructional Design). Each participant bought a copy of the manual and was loaned the computer disks.
3. The tutorial computer program presented the components of course development, self-checks of understanding, and exercise assignments.
4. Exercises were completed using the manual.
5. Computer literacy was not required.
6. Each participant selected their own content area around which an instructional program was to be developed.
7. Participants met the first day of the first University summer session from 9:05 AM to 4:00 PM on the University campus. They received an overview of the course and an orientation to the use of the computers and manual.

8. They worked independently throughout the rest of the summer with access to the instructor based on their perceived need.
9. Individual meetings with the instructor could be arranged, or people could call the instructor "collect" on Tuesday and Thursday afternoons.
10. Assignments on components of course development were turned in to the instructor throughout the summer and returned to the participant after review without grading. (A schedule for completing assignments was distributed.)
11. The final project contained examples of each of the components of the instructional design process for planning a course (program) to prepare people to perform a desired set of behaviors (tasks). It was graded.
12. A "wrap-up" session was conducted at the end of the Summer Session. It included a discussion of participant course development experiences and a final examination. The exam contained items which measured performance capability as well as understanding.

The primary goal was not to develop an entire course or program during the course, but to provide experience with the entire course development process and to allow participants to develop model components for a course or program of their choice. Therefore, the quality of what was produced was more important than the quantity. It was assumed that if participants mastered the course development process, they could readily apply it in the future.

Participant Characteristics

Twenty-one people enrolled in the course. Table 1 indicates the reasons why they enrolled. Fourteen enrolled to meet

Table 1

Reasons Why People Enrolled

Reason	Frequency
* To meet Minnesota teacher licensing requirements	14
* To learn course development procedures to improve vocational courses or training programs	9
* To fulfill a graduate degree requirement	2
* To learn the PBID System as an alternative instructional design system	2

Minnesota teacher licensing requirements, 9 to learn course development procedures to improve vocational courses or training programs, 2 to meet graduate degree requirements, and 2 to learn the PBID System as an alternative instructional design system. People could have indicated more than one reason.

Table 2 indicates the percentage of participants who had prior experience in course development. Seventy-six percent indicated they had prior experience in course development and 24% indicated they had not.

Table 2

Prior Experience in Course Development

Yes	76%
No	24%

Table 3 indicates the percentage of participants who had prior experience with computers. Ninety-five percent indicated they had prior experience and 5% indicated they had not. Of those who had prior experience, 90% indicated they had used a computer frequently and 10% indicated rarely.

Table 3

Prior Computer Experience

Yes 95%

No 5%

The range of experience was substantial, both in terms of number of years and type. One person had 20 years of experience as a data processing consultant. Most of the people had word processing experience. Some had experience with computer-aided drafting, programming, data basis and/or robotics.

Eighty-six percent of the participants had a good or very good opinion of computer-assisted instruction before the course started. Fourteen percent did not. Fifty-two percent of the people indicated they had taken a computer-taught class before. Forty-eight percent of the participants enrolled in the course primarily because it was offered using computer-assisted instruction.

Only 10% of the participants indicated they were somewhat fearful about using a computer while 90% felt confident. Ninety percent of the people felt the computer-assisted format of the course would help them as an instructor.

Participants were asked to indicate any advantages or disadvantages they foresaw in taking the course using CAI. Table

4 presents the perceived advantages and disadvantages before taking the course.

Table 4

Perceived Advantages and
Disadvantages of the Course Format
(Before taking the course)

Advantages	Disadvantages
* Limited class time	* No instructor to ask questions (2)
* Can work at home at own schedule (2)	* Impersonal
* Self study at own speed (4)	
* Practice with a new development tool (2)	
* Help me feel more at ease with computers (3)	
* Experience using CAI (3)	

Results

Learner Reactions

Eighteen of the 21 people who started the class completed it. One person's teaching position was eliminated so he dropped the course. Two others took incompletes. One of the people who completed the course did not want to be in the course but had to take it to renew an expiring license. He came late the first day, lost his assignment schedule, did not want to use a computer, etc. His data were eliminated from the following discussion of course results. Therefore, the data presented reflect 17 of the original 21 people who began the course.

Participants were asked to indicted how many students they thought should attend this course at one time. They indicated that it would depend upon the instructors' workload.

Forty-seven percent of the people indicted that their attitudes toward CAI changed for the better upon taking the

course. Seventy-six percent had very good or good opinions about CAI while 24% had fair or poor opinions. One more person had fair or poor opinion after taking the course than had fair or poor opinions before taking the course. One-hundred percent indicated they were not fearful of using a computer. This was in contrast to two feeling fearful upon starting the course. Eighty-two percent of the people indicated that the CAI format of the course would help them as instructors while 18% did not. One more person indicated that the CAI format of the course would not be helpful at the end of the course than indicated so at the beginning of the course.

Table 5 presents the participants perceived advantages and disadvantages of the computerized independent study format of the course after taking the course.

Table 5

Perceived Advantages and
Disadvantages of the Course Format
(After taking the course)

Advantages	Disadvantages
* Flexibility of doing the work at my own schedule (4)	* The CAI format took too much time
* Self-pacing and individual access to the instructor	* Missed the interaction with other students (2)
* Completeness of the course	* Textbook would have been easier to use - looking back over material
* Saved travel time and money	* Missed immediate classroom feedback

Eighty-eight percent of the participants responded to the question, "Were your expectations for this course met?" Ninety-three percent of those respondents indicated that their

expectations were met and 7% (1 person) indicated they were not. That person did not like the CAI portion of the course because s/he felt working with the computer was busy work. Appendix A presents a list of general comments regarding the course. The general comments were predominantly favorable.

Appendix B presents the participants' evaluations of the software itself using an instrument developed by Heinich, Molenda, and Russell (1985) to evaluate educational software. The majority of the participants rated the PBID program high on each of the evaluation criteria. The criterion with the lowest rating (12% rated the item low) was "frequent interaction and positive reinforcement/feedback." This is understandable because the program was not designed to provide feedback on the assignments. That is provided through instructor evaluation of the completed assignments.

Learner Learning

The course was presented using self-paced mastery instruction. Learners were provided non-graded feedback on each of the assignments by the instructor. Errors were highlighted and instruction was provided to correct misconceptions before the final composite project was submitted for grading. The project was graded using a performance checklist reflecting each of the components of the PBID System. The final test included items designed to test performance and understanding. Learners were asked to develop selected components of the PBID System as a performance evaluation and multiple-choice items were used to test understanding.

Both the project and the final test were graded by the instructor using criterion versus norm referenced grading. An A represented 90% or more; a B, 89 to 80%; and a C, 79 to 70%. Forty-seven percent of the people earned a grade of A and 53% earned a grade of B. A grade of C was viewed as minimal mastery level. Therefore, it was judged that all of the people mastered the course development procedures using the distance delivery CAI approach. Furthermore, based on past experience teaching the course traditionally, the quality of the products received from the participants was much higher and more uniform than those received from participants who did not use the CAI program in the past. This has been a repeated finding of University of Minnesota instructors who have used the CAI program to teach the course, regardless of the CAI format used.

Insights Into Course Delivery

The delivery of teacher education courses through distance delivery CAI poses some unique planning and delivery problems for teacher educators. Each of them will be discussed briefly.

Course structure is important. The course must be clearly structured with due dates for course components. This ensures that learners pace themselves and can benefit from constructive feedback. Using a course development system such as the PBID System requires that learners build components upon prior components. If the prior components are completed incorrectly, the subsequent components will also be incorrect.

Course orientation is also important to the success of such a distance delivery course. The learners must receive a clear

understanding of the course structure and expectations before they leave to go to their independent study sites. Without such an orientation they tend to get lost.

Participants must also be oriented to the differences in techniques for studying using CAI versus standard classroom sessions and textbooks. Typically people watching television passively observe what is happening on the screen. There is an initial tendency to observe the CAI program with the same orientation. However, with CAI learners must carefully study the content on each screen, just as they would study content in a textbook. Reviewing material within the program is also different than turning back the pages of a textbook. Reviewing in CAI is accomplished through menus which allow learners to return to a portion of the program. Therefore, they must understand the menu structure of the CAI program in order to readily move about within it and reference material of interest.

People who came to the opening course session late and who did not receive the total course orientation had more difficulty getting started than those who attended the full orientation.

Past experience, has also indicated that one can not assume any prior knowledge of computers and their operation. Learners can quickly get "bogged down" with the computer technology if they are not properly oriented. They need to be "walked through" sample portions of the program as they actually operate a computer with the program.

Teaching time was initially perceived to be the item most affected by changing from a traditional to a distance deliver

format. However, further analysis indicated it was not. When teaching a traditional course the instructor can plan her/his schedule based on knowing when the class sessions will occur. It is possible to get "psyched-up" to teach the course and to develop a readiness to think about questions pertaining to the course. When the course is offered on an independent study basis, it is possible for a learner to walk in or call whenever the instructor is in the office. Therefore, it appears that a much larger amount of effort is being devoted to the course than if it were taught traditionally because of the psychological interruptions. However, based on this experiment, the amount of instructor time devoted to the delivery of instruction and feedback was about the same. The instructor in this experiment spent 9 hours in actual formal class sessions and 20 hours meeting with learners, talking with them on the phone and providing feedback on class assignments. This does not include course preparation or grading of projects or assignments, which would be similar whether using the experimental approach or traditional instruction. Typically a 3 quarter credit course would meet for about 30 hours of in-class instruction. Therefore, it appears that teaching a course using distance delivery CAI takes about the same amount of time as teaching it using the traditional method.

Learner time was also very similar to that devoted to a traditional course. Participants were asked to indicated the number of hours beyond scheduled class time they spent on assignments. Table 6 presents the numbers of hours they indicated.

Table 6

Hours Spent Homework Assignments

% Frequency	Hours
41	21-30
23	31-40
12	41-50
6	51-60
6	61-70
12	71-80

Learners reported spending an average of 40 hours of out of class time working on the outside assignments with a range from 21 to 80 hours. This does not include time they spent studying for the final exam. Typically learners would be expected to spend a total of 60 additional hours studying outside of class. Therefore, it appears that learner effort was about the same as one would expect for a typical teacher education course.

Conclusions

The primary advantages to using such a course format are:

1. People can study the course using their own pace.
2. They can complete the course at remote locations.
3. Teacher education institutions can save the time and money required to delivery traditional courses at remote sites.
4. Learners can save the time and money required to attend traditional classes at distant sites.
5. Because of the individualized attention and self-pacing possible, mastery of the course content is more probable and the quality of products produced is higher.

The primary disadvantages to using such a course format are:

1. Lack of immediate feedback possible in a classroom.
2. The time it takes to operate a computer.
3. The inability to immediately refer to other locations within a computer program, which is possible within a textbook.

Overall, based on participant reactions, amount of learning, and time and effort of learners and the instructor, it appears that distance delivery CAI is a viable alternative delivery system for vocational teacher education courses such as course development. The amount of instructor and learner effort required for such a course is very similar to that required for a traditional course. The quality of the products is higher and the self-paced nature of the course allows learners to achieve mastery more readily than is possible using traditional courses.

Learners evaluated the particular CAI program used (Performance-Based Instructional Design) as being effective and easy to operate. They also indicated that they achieved their course goals, obtaining more experience with computers and learning how to develop courses for vocational education and training in business and industry.

Appendix A

General Participant Comments

Question: Are there any additional comments you would like to make about this course or the method of instruction used?

Answers:

- Helps to be able to be on independent basis. Can't see it being necessary to have any additional in-class time when professor makes hours available for individual problems.

- Enjoyed it and would recommend to beginner curriculum designer or beginning trainer (as review or new format information for more experienced individuals).

- I attended a State Board for Vocational Education workshop on restructuring several weeks ago on course planning. As part of a unit on writing syllabi, we were provided with a list of "legitimate verbs." This could have been helpful in the early stages of this course. Turn around timetables were a little short on the last few assignments.

- It suited me fine. I think that having the worksheets on screen instead of separate (in the manual) would make for a more "slick" product, but I'm sure it would add a lot of programming time hence cost to the product.

- Need more like it.

- I thought it was a great course and it was very well done and organized. I learned a lot! I wish the University would offer more courses like this - I think more people would take classes.

- Progress check list for student (list of subject matter, exercises, & self-tests completed); templates for carrying out exercises on the computer would have been helpful.

- If the assignments could be written on the computer and then printed out it would save an extra step for the student.

- I would encourage anyone to take it.

- As students can only reach the instructor at specific times, his being available at these times is of PRIME IMPORTANCE (as students may be in the middle of working on an assignment). I was surprised at how efficiently the mailing worked - except for the last assignment which reached me late.

- I appreciate being able to understand better how to think about affective behavior in performance terms.

- Basically, I thought I learned a lot more (in a unique way) about course construction and am finishing this course with a very favorable attitude. I am now trying to integrate some form of computer based learning into my course curriculum.

- I want to continue to practice what I have learned so it becomes natural and I feel completely at ease.

Appendix B

Appraisal Checklist: Computer-Based Instruction *

Items	Percent			
	High	Medium	Low	Item N
Focuses clearly on objectives relevant to instructional needs	94	6	-	17
Quality of documentation (clear and complete)	69	31	-	16
User-friendly, simple interactions	88	12	-	17
Error-free (no infinite loops or dead ends)	88	12	-	17
Learner control of pace and sequence	94	6	-	17
Frequent interaction and positive reinforcement/feedback	76	12	12	17
Branches to adapt to varying aptitude levels	80	13	7	15
Handling of user errors	76	18	6	17
Motivating presentation format and screen displays	76	24	-	17
Appropriate graphics, sound, and color	76	24	-	17
Clear and concise adjunct materials	75	19	6	16
Evidence of effectiveness (e.g., field tests)	84	8	8	13

* Heinich, Molenda, & Russell. (1985). Instructional Media. John Wiley & Sons, Inc., New York.

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